REMARKS

At the outset, the Examiner is thanked for the thorough review and consideration of the subject application. The Office Action of March 25, 2002 has been received and contents carefully reviewed.

Claims 1-25 are pending, and independent claims 1, 10, 11, and 21-23 have been amended.

The Examiner rejected claims 1, and 19-21 as being unpatentable over Nelson (US Patent No. 4,147,581) in view of Chung et al. (US Patent No. 5,000,795), rejected claims 2, 7, 10, 22, and 25 as being unpatentable over Nelson (US Patent No. 4,147,581) in view of Chung et al. (US Patent No. 5,000,795) and Tittle (US Patent No. 4,886,590), rejected claims 3-6, 8, 9, 11-18, 23, and 24 as being unpatentable over Nelson (US Patent No. 4,147,581) in view of Chung et al. (US Patent No. 5,000,795), Jones (US Patent No. 3,869,313) and Tittle (US Patent No. 4,886,590).

Applicants respectfully assert that the prior art references, singly or in combination, do not teach or suggest all of the claim limitations of at least independent claims 1, 10, 11, and 21-23.

Claims 1 and 21

As the Examiner noted in the Action, Nelson fails to show immersion of a substrate in an etch bath or a bubble plate. The Examiner cited Chung et al. as disclosing the elements not taught by Nelson.

Claim 1 recites "...an etch bath for immersing said glass substrate in said first etchant, said etch bath having a bubble plate, the etch bath being connected to the first tank and

receiving the first etchant, the etch bath containing a residual etchant including a diluted etchant and residue material after the glass substrate is etched with the first etchant to uniformly reduce a thickness of the glass substrate...; ...wherein an etched thickness of the glass substrate is derived from the temperature of the first etchant..."

Claim 21 recites "...an etch bath for immersing the glass substrate in the first etchant, the etch bath having a bubble plate for generating nitrogen bubbles, the bubble plate being connected to a nitrogen inlet pipe, the nitrogen inlet pipe being connected to a nitrogen supply line, the etch bath being connected to the first tank and receiving the first etchant, the etch bath containing a residual etchant including a diluted etchant and residue material after the glass substrate is etched with the first etchant to uniformly reduce a thickness of the glass substrate; ...wherein an etched thickness of the glass substrate is derived from the temperature of the first etchant..."

In column 4 of Nelson, metal is dissolved from the surface of the solid by etching solution. In column 2 of Chung et al., the purpose of the cleaning tank is to clean the wafers by reacting impurities with the sulfuric acid and an injected reagent chemical such as hydrogen peroxide. However, none of the cited references teaches or suggests uniformly reducing a thickness of the glass substrate wherein the etched thickness of the glass substrate is derived from the temperature of the first etchant as recited by claims 1 and 21.

Claims 1 and 21 recite "a connecting passage connecting the first and second tanks for transferring the separated diluted etchant from the second tank to the first tank." The Examiner asserts that the etcher of Nelson reads on the claimed first tank and that the rinse chamber of Nelson reads on the claimed second tank. Office Action at P. 2 (citations

omitted). However, the combined stream 31 of Nelson cannot read on the claimed connecting passage. The combined stream 31 of Nelson does not connect the etcher and the rinse chamber; the combined stream 31 of Nelson connects the bulk storage tank to the etcher. Thus, the combined stream 31 of Nelson cannot read on the claimed connecting passage.

Furthermore, the etchable material passes via stream 1 into etcher 2. The etched solids are removed from the etcher 2 via stream 3, which passes into liquid rinse chamber 4. Applicants respectfully submit that etcher 2 and rinse chamber 4 cannot read on the first tank and the second tank recited by claims 1 and 21.

Accordingly, with regard to claims 1 and 21, the combination of references fails to teach or suggest at least first tank, an etch bath having a bubble plate, a second tank, uniformly reducing a thickness of the glass substrate wherein the etched thickness of the glass substrate is derived from the temperature of the first etchant, and a connecting passage connecting a first tank with a second tank, all of which are recited by claims 1 and 21.

Moreover, dependent claims 2-9, and 19 are believed to be allowable by virtue of their dependence on claim 1, which is believed to be allowable.

Therefore, Applicants assert that the combination of references fails to teach or suggest all of the claim elements, as is required to support *prima facie* obviousness.

Claims 10 and 22

Claim 10 recites *inter alia* the following elements:

> a control unit for receiving a signal indicating the temperature of the etchant from the temperature sensor and transmitting an etching termination signal to the etch bath when the temperature reaches a target temperature;

wherein an etched thickness of the glass substrate is derived from the temperature of the first etchant.

Claim 22 recites *inter alia* the following elements:

a control unit for receiving a signal indicating the temperature of the etchant from the temperature sensor and transmitting an etching termination signal to the etch bath when the temperature reaches a target temperature;
wherein a reaction heat generated from etching the glass substrate changes the temperature of the etchant;

wherein an etched thickness of the glass substrate is derived from the temperature of the first etchant.

In the Office Action, the Examiner rejects claims 10 and 22 by citing the rejection of claims 1 and 21 over Nelson and Chung et al., in further view of Tittle.

Chung et al. fails to cure the deficiencies of Nelson in that Chung et al. fails to teach or suggest at least a glass substrate, temperature sensor and control unit. Furthermore, Nelson and Chung et al., even if combined, fail to teach or suggest at least a temperature sensor and a control unit as recited in claims 10 and 22.

The Examiner cites Tittle as disclosing the elements lacking in Nelson and Chung et al. Specifically, the Office Action states "Tittle et al disclose a process control system having a plurality of sensors for sensing various parameters. One of the parameters for controlling the process may include temperature. A formula may be used to compute bath effectiveness based on the parameters detected. Any variation of the effectiveness triggers a responsive change. A response change can be the termination of the etch process." Office Action at P. 4.

Applicants respectfully disagree. Tittle fails to teach or suggest wherein an etched thickness of the glass substrate is derived from the temperature of the first etchant, as in claims 10 and 22.

Moreover, dependent claim 20 is believed to be allowable by virtue of its dependence on claim 10, which is believed to be allowable.

Therefore, Applicants assert that the combination of references including Nelson, Chung et al. and Tittle fails to teach or suggest all of the claim elements, as is required to support *prima facie* obviousness.

Claims 11 and 23

Claim 11 recites *inter alia* the following elements:

> an etch bath having a bubble plate for generating nitrogen bubbles, the bubble plate being connected to a nitrogen inlet pipe, the nitrogen inlet pipe being connected to a nitrogen supply line, the etch bath being connected to the first tank connected to the first tank for receiving the first etchant and adapted to etch the glass substrate;
>
> a separation tank adapted to receive the residual etchant from the etch bath for separating the diluted etchant from the residue material, the separation tank connected to the etch bath via an etchant outlet pipe, the separation tank transferring the separated diluted etchant to the first tank;
>
> wherein an etched thickness of the glass substrate is derived from the temperature of the first etchant.

Claim 23 recites *inter alia* the following elements:

> an etch bath for immersing the glass substrate in the first etchant, the etch bath having a bubble plate for generating nitrogen bubbles, the bubble plate being connected to a first nitrogen inlet pipe, the nitrogen inlet pipe being connected to a nitrogen supply line, the etch bath being connected to the first tank for

receiving the first etchant and adapted to etch the substrate with the first etchant to uniformly reduce a thickness of the glass_substrate, the etch both producing a residual etchant including a diluted etchant and residue material as a result of etching the substrate;

a separation tank adapted to receive the residual etchant from the etch bath for separating the diluted etchant from the residue material, the separation tank connected to the etch bath via an etchant outlet pipe, the separation tank transferring the separated diluted etchant to the first tank;

wherein an etched thickness of the glass substrate is derived from the temperature of the first etchant.

In the Office Action, the Examiner rejects claims 11 by citing the rejection of claims 1 and 21 over Nelson and Chung et al., in further view of Jones et al. and Tittle.

Nelson has been discussed above. Chung et al. fails to cure the deficiencies of Nelson. Moreover, Nelson and Chung et al. fail to teach or suggest at least the first tank, the etch bath, the separation tank, the rinse bath, the dry bath, the etchant supply source, the solvent supply source, and the control unit, as recited in claims 11 and 23.

The Examiner cites Jones et al. as disclosing the elements lacking in Nelson and Chung et al. Specifically, the Office Action states "Jones et al disclose a chemical processing apparatus containing a plurality of treatment chambers having a dip chamber with filling pumps, a spray chamber which serves as a rinse chamber or a drying chamber. The rinse chamber would be filled with deionized water from a deionized reservoir. An essential part of the apparatus is a conveyor means for automatically transferring the workpieces from treatment chamber to treatment chamber. The conveyor allows for a plurality of substrates to be processed substantially at the same time. Using a pump to move fluid from one chamber to another is conventional." Jones further teaches a 'controlled heater 67' used in the

'treatment' chamber that 'may be used as a drying chamber.' " Office Action at P. 5. The Examiner further cites Tittle as disclosing "a temperature sensor or a concentration measuring." Office Action at P. 6.

However, Tittle and Jones et al. fail to cure the deficiencies of Nelson and Chung et al. *inter alia*, Tittle and Jones et al. fail to teach or suggest uniformly reducing a thickness of the glass substrate wherein the etched thickness of the glass substrate is derived from the temperature of the first etchant as recited by claims 11 and 23.

Moreover, dependent claims 12-18, 24, and 25 are believed to be allowable by virtue of their dependence on claims 11 and 23, which are believed to be allowable.

Therefore, Applicants assert that the combination of references fails to teach or suggest all of the claim elements, as is required for *prima facie* obviousness.

Therefore, Applicants respectfully request reconsideration of the claims rejected over the combination of Nelson, Chung et al., Tittle, and Jones et al.

In view of the foregoing Amendments and Remarks, Applicants respectfully submit that the application is in condition for allowance and early, favorable action is respectfully solicited.

If the Examiner deems that a telephone conference would further the prosecution of this application, the Examiner is invited to call the undersigned attorney at (202) 496-7371. All correspondence should continue to be sent to the below-listed address.

If these papers are not considered timely filed by the Patent and Trademark Office, then a petition is hereby made under 37 C.F.R. §1.136, and any additional fees required under 37 C.F.R. §1.136 for any necessary extension of time, or any other fees required to complete

the filing of this response, may be charged to Deposit Account No. 50-0911. Please credit any overpayment to deposit Account No. 50-0911. A duplicate copy of this sheet is enclosed.

Respectfully submitted,

MCKENNA LONG & ALDRIDGE LLP

By: 
Teresa M. Arroyo
Registration No: 50,015

Date: June 24, 2002

1900 K Street, N.W.
Washington, DC 20006
Telephone (202) 496-7500
Facsimile (202) 496-7756

MARKED-UP VERSION OF AMENDED CLAIMS

1. (Amended) An etching apparatus for etching a glass substrate comprising:

a first tank including a first etchant;

an etch bath for immersing said glass substrate in said first etchant, said etch bath having a bubble plate, the etch bath being connected to the first tank and receiving the first etchant, the etch bath containing a residual etchant including a diluted etchant and residue material after the glass substrate is etched with the first etchant to uniformly reduce a thickness of the glass substrate;

a second tank for receiving the residual etchant from the etch bath and separating the diluted etchant from the residue material;

a connecting passage connecting the first and second tanks for transferring the separated diluted etchant from the second tank to the first tank; [and]

an outlet pipe attached to the second tank for discharging the residue material; and

a control unit for receiving a signal indicating the temperature of the etchant from a temperature sensor and transmitting an etching termination signal to the etch bath when the temperature reaches a target temperature;

wherein an etched thickness of the glass substrate is derived from the temperature of the first etchant.

10. (Amended) An etching apparatus for etching a glass substrate with an etchant, comprising:

an etch bath adapted to receive the substrate immersed into the etchant for etching the glass substrate to uniformly reduce a thickness of the glass substrate;

a temperature sensor installed in the etch bath for monitoring a temperature of the etchant while the glass substrate is etched in the etch bath; and

a control unit for receiving a signal indicating the temperature of the etchant from the temperature sensor and transmitting an etching termination signal to the etch bath when the temperature reaches a target temperature;

wherein an etched thickness of the glass substrate is derived from the temperature of the first etchant.

11. (Amended) An etching apparatus for etching a glass substrate comprising:

a first tank including a first etchant;

an etch bath for immersing said glass substrate in said first etchant, said etch bath having a bubble plate, the etch bath being connected to the first tank for receiving the first etchant and adapted to etch the substrate with the first etchant to uniformly reduce a thickness of the glass substrate, the etch both producing a residual etchant including a diluted etchant and residue material as a result of etching the substrate;

a separation tank adapted to receive the residual etchant from the etch bath for separating the diluted etchant from the residue material, the separation tank transferring the separated diluted etchant to the first tank;

a rinse bath for cleaning the glass substrate that is etched in the etch bath;

a dry bath for drying the glass substrate that is rinsed at the rinse bath;

a solvent supply source for supplying solvent water to the first tank;

an etching solution source for supplying an etching solution to the first tank; and

a control unit for controlling the etch bath, the rinse bath, the dry bath, the first tank, and the separation tank;

wherein an etched thickness of the glass substrate is derived from the temperature of the first etchant.

21. (Amended) An etching apparatus for etching a glass substrate comprising:

a first tank including a first etchant;

an etch bath for immersing the glass substrate in the first etchant, the etch bath having a bubble plate for generating nitrogen bubbles, the bubble plate being connected to a nitrogen inlet pipe, the nitrogen inlet pipe being connected to a nitrogen supply line, the etch bath being connected to the first tank and receiving the first etchant, the etch bath containing a residual etchant including a diluted etchant and residue material after the glass substrate is etched with the first etchant to uniformly reduce a thickness of the glass substrate;

a second tank for receiving the residual etchant from the etch bath and separating the diluted etchant from the residue material;

a connecting passage connecting the first and second tanks for transferring the separated diluted etchant from the second tank to the first tank; [and]

an outlet pipe attached to the second tank for discharging the residue material; and

a control unit for receiving a signal indicating the temperature of the etchant from a temperature sensor and transmitting an etching termination signal to the etch bath when the temperature reaches a target temperature;

wherein an etched thickness of the glass substrate is derived from the temperature of the first etchant.

22. (Amended) An etching apparatus for etching a glass substrate with an etchant, comprising:

an etch bath adapted to receive the glass substrate immersed into the etchant for etching the glass substrate to uniformly reduce a thickness of the glass substrate;

a temperature sensor installed in the etch bath for monitoring a temperature of the etchant while the glass substrate is etched in the etch bath; and

a control unit for receiving a signal indicating the temperature of the etchant from the temperature sensor and transmitting an etching termination signal to the etch bath when the temperature reaches a target temperature,

wherein a reaction heat generated from etching the glass substrate changes the temperature of the etchant;

wherein an etched thickness of the glass substrate is derived from the temperature of the first etchant.

23. (Amended) An etching apparatus for etching a glass substrate comprising:

a first tank including a first etchant;

an etch bath for immersing the glass substrate in the first etchant, the etch bath having a bubble plate for generating nitrogen bubbles, the bubble plate being connected to a first nitrogen inlet pipe, the nitrogen inlet pipe being connected to a nitrogen supply line, the etch bath being connected to the first tank for receiving the first etchant and adapted to etch the substrate with the first etchant to uniformly reduce a thickness of the glass substrate, the etch

both producing a residual etchant including a diluted etchant and residue material as a result of etching the substrate;

a separation tank adapted to receive the residual etchant from the etch bath for separating the diluted etchant from the residue material, the separation tank connected to the etch bath via an etchant outlet pipe, the separation tank transferring the separated diluted etchant to the first tank;

a rinse bath for cleaning the glass substrate that is etched in the etch bath;

a dry bath for drying the glass substrate that is rinsed at the rinse bath;

a solvent supply source for supplying solvent water to the first tank;

an etching solution source for supplying an etching solution to the first tank; and

a control unit for controlling the etch bath, the rinse bath, the dry bath, the first tank, and the separation tank;

wherein an etched thickness of the glass substrate is derived from the temperature of the first etchant.